

Appl. No. : 09/943,217
Filed : August 29, 2001

REMARKS

Claims 10 and 12 have been amended. New claims 14-15 are added. Claims 1-15 are now pending in this application. Claim 10 was amended to correct an obvious typographical error. Support for the remaining amendments is found in the existing claims. Accordingly, the amendments do not constitute the addition of new matter. Applicant respectfully requests the entry of the amendments and reconsideration of the application in view of the amendments and the following remarks.

Rejection under 35 U.S.C. § 112, second paragraph

Claim 12 is rejected under 35 U.S.C. § 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

This ground of rejection is believed to be overcome by Applicants' amendment of claim 12 and addition of claims 14-15.

In view of Applicants' amendments, reconsideration and withdrawal of this ground of rejection is respectfully requested.

Rejection under 35 U.S.C. § 103(a)

Claims 1-13 are rejected under 35 U.S.C. § 103(a) as unpatentable over Tan (Macromolecules article) or Tan (ACS Preprints) or CN 1257885 in view of Stevens '415.

The Examiner asserts that each of the primary references teach polymerization of polycarbonate from carbon dioxide and propylene oxide using a catalyst which is a combination of Yttriumtrihaloacetate, diethyl zinc and glycerol. The references do not teach ethylene carbonate or propylene carbonate. The Examiner posits that propylene carbonate would be an inevitable by-product of the reaction based upon the Stevens reference and asserts that it would have been obvious to recycle this propylene carbonate by-product back into the feed which would result in the 4-part catalyst of Applicants' claims.

In order to provide a *prima facie* case of obviousness, the Patent and Trademark Office has the burden to provide a motivation, teaching or suggestion to create the claimed invention. *See, e.g., In re Fine*, 5 U.S.P.Q.2d 1597 (Fed. Cir. 1988). Such motivation, teaching or suggestion is absent in the references cited by the Examiner.

Stevens teaches a catalyst system which is typical of anionic polymerization catalyst systems which are primarily 2-component catalysts composed of alcohols bearing active

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hydrogen and alkaline compounds, such as ethylene glycol + NaHCO_3 . In contrast, the catalyst systems used in the present application and in the primary references are coordination catalyst systems. Motivation to combine the teaching of the primary references on a 3-component coordination catalyst system with the two-component anionic polymerization catalyst system taught by Stevens is not found in any of the cited references.

Furthermore, the cited references taken together do not provide for a reasonable expectation of success. The objective of Stevens is merely to recycle the by-product of cyclic carbonate to the reacting system to react with ethylene oxide to form polycarbonate. The effect of the recycled carbonate of Stevens on the 3-component coordination catalyst system of the primary references could not have been predicted by one of ordinary skill in the art at the time of the claimed invention. Based upon the disclosure in Stevens, that carbonate could be recycled back into the reacting system as a monomer to take part in the reaction, one of ordinary skill in the art might have concluded that the recycled carbonate as a by-product could take part in the polymerization as a monomer to raise the degree of utilization of the monomer. One of ordinary skill in the art would not conclude that the recycled carbonate could interact synergistically with the 3-component catalyst of the primary reference to significantly raise the activity of the catalyst. Therefore, even if one of ordinary skill in the art did combine the teachings of the primary references with the teaching of Stevens, they could at best predict improvement in the degree of utilization of the monomer. It could not have been predicted that recycled carbonate could be used in a catalytic manner to improve the catalytic activity of a three-component system. Thus, there was no motivation to combine Stevens with any of the primary references and, once combined, there is no reasonable expectation of success for achieving a four-component catalyst.

Furthermore, even if a *prima facie* case has been established (and Applicants maintain that it has not), the improved results reported by Applicants due to the synergistic effects of the addition of carbonate to the three component system disclosed by the primary references could not have been predicted by the references cited, alone or in combination.

Tan reports that the maximum yield with the catalytic activity of the 3-component system is 4200 g polymer/mol Y/h in a 12 hour reaction (see Abstract of Macromolecules paper). In contrast, Applicants' maximum yield reported is 8,040 g polymer/mol Nd/h in a 10 hour reaction (Example 1). Results reported in Examples 2-6 are comparable for 10-12 hour reaction times.

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This high yield was unexpected and could not have been predicted based upon the teachings of the cited references.

Additionally, the high molecular weight achieved by the use of Applicants' claimed four component catalyst also could not have been predicted based upon the cited references.

Applicants teach a number average molecular weight Mn of 101,000 in Example 4. Mn for other examples is comparable. While Tan (Macromolecules) teaches a molecular weight of 100,000, this is a maximum molecular weight and cannot be properly compared to Applicants' number average molecular weight. It is noted that Stevens teaches much lower molecular weights of 700-5000 (see col. 1, lines 19-21). None of the cited references alone or in combination teach an aliphatic polycarbonate with the high yield and the high Mn as taught by Applicants.

In addition, Applicants' would like to argue the following advantages over the cited art. First, in the four component catalyst of the present invention, carbonate could interact more thoroughly with the other components and consequently could bring the modification effect of the carbonate on the catalyst into full play. If the recycled carbonate is simply mingled with the reacting system as would be suggested by the teaching of Stevens, the contact between the recycled carbonate and the 3-component catalyst of the primary references is not sufficient. As a result catalytic activity could not be raised significantly and the polymerization time could not be shortened.

Second, due to the existence of carbonate, the formation of carbonate in common polymerization process could be inhibited, and the efficiency of the polymerization reaction can be improved.

Third, during the course of making up of the catalyst, carbonate could serve as a medium. Therefore, the difficult situation of the necessity of employing organic solvent during the course of making up of the catalyst in the bulk copolymerization of carbon dioxide with epoxide is solved. In other words, it is possible to avoid the use of organic solvents.

In view of Applicants' amendments and arguments, reconsideration and withdrawal of this ground of rejection is respectfully requested.

CONCLUSION

In view of Applicants' amendments to the claims and the foregoing Remarks, it is respectfully submitted that the present application is in condition for allowance. Should the Examiner have any remaining concerns which might prevent the prompt allowance of the

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application, the Examiner is respectfully invited to contact the undersigned at the telephone number appearing below.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

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